AMENDMENTS TO THE CLAIMS

The following listing of claims replaces all prior versions and listings of claims. These claims are reflected in the substitute specification.

1. (Currently Amended) An engine control system comprising:

an ion current measuring unit ~~that~~ adapted to measures ~~the~~ a negative ion current in a combustion chamber of an engine;

a crank-angle measuring unit ~~that measures~~adapted to measure an engine crank angle; and

a controller ~~that~~ adapted to controls the engine on the basis of a first crank angle at which ~~the~~ an increase rate of the negative ion current ~~against~~ relative to the crank angle becomes more than a first specified value and a second crank angle at which the increase rate becomes a second specified value after becoming the first specified value.

2. (Currently Amended) The engine control system according to Claim 1, wherein

the first crank angle is a crank angle corresponding to ~~the~~ a rising point of the negative ion current on a negative ion current curve indicative of variations in negative ion current ~~against~~ relative to crank angles; and

the second crank angle is a crank angle corresponding to ~~the~~ a peak point of the negative ion current on the negative ion current curve.

3. (Currently Amended) The engine control system according to Claim 2, wherein the controller is adapted to calculates from the first crank angle and the second crank angle a third crank angle corresponding to ~~the~~ a fuel center of gravity ~~from the first crank angle and the second crank angle~~, and the controller is adapted to control ~~controls~~ the ~~engine~~ an engine ignition timing so that the third crank angle ~~reaches~~ approximates a specified target crank angle.

4. (Currently Amended) The engine control system according to Claim 3, wherein the specified target crank angle is ~~set so as not to be~~ not changed according to engine load conditions.

5. (Currently Amended) The engine control system according to Claim 3, wherein the ~~crank angle is set to a~~ specified crank angle corresponds ~~ing~~ to MBT.

6. (Currently Amended) The engine control system according to Claim 3, wherein the specified target crank angle is set to a ~~specified~~ predetermined crank angle delayed behind MBT.

7. (Currently Amended) The engine control system according to Claim 2, wherein the controller is adapted to calculates ~~the~~ a variation rate of the third crank angle corresponding to the fuel center of gravity from the first crank angle and the second crank angle, and the controller is adapted to controls ~~the~~ an exhaust gas recirculation (EGR) rate of the engine so that the ~~engine~~ EGR rate decreases when the ~~with increasing~~ variation rate increases.

8. (Currently Amended) The engine control system according to Claim 2, wherein the controller is adapted to calculates ~~the~~ a variation rate of the third crank angle corresponding to the fuel center of gravity from the first crank angle and the second crank angle, and the controller is adapted to controls ~~the~~ an open-close timing of an intake valve and an exhaust valve of the engine so that the overlap period of the intake valve and the exhaust valve decreases ~~with~~ as the variation rate increases~~increasing variation rate~~.

9. (Currently Amended) The engine control system according to Claim 1 in combination with a~~A~~ vehicle ~~comprising an engine and the engine control system according to one of Claims 1 to 8~~.

10. (Currently Amended) A method for calculating ~~the~~ a fuel center of gravity of an engine, the method comprising ~~the steps of~~:

measuring ~~the~~ a negative ion current in a combustion chamber of the engine;

determining a first crank angle at which ~~the~~ an increase rate of the negative ion current ~~against~~ relative to an ~~the~~ engine crank angle ~~becomes more than~~ exceeds a first specified value;

determining a second crank angle at which the increase rate becomes a second specified angle after ~~becoming~~ exceeding the first specified value~~angle~~; and

calculating the fuel center of gravity from the first crank angle and the second crank angle.

11. (Currently Amended) A method for controlling the operation of an engine, the method comprising ~~the steps of~~:

measuring ~~the~~ a negative ion current in a combustion chamber of the engine;

determining a first crank angle at which ~~the~~ an increase rate of the negative ion current ~~against~~ relative to an engine crank angle ~~becomes more than~~ exceeds a first specified value;

determining a second crank angle at which the increase rate becomes a second specified angle after ~~becoming~~ exceeding the first specified ~~angle~~value; and

controlling the engine on the basis of the first crank angle and the second crank angle.

12. (Currently Amended) The method for controlling the operation of an engine according to Claim 11, wherein

the step of controlling the engine comprises ~~the steps of~~:

calculating a third crank angle corresponding to the fuel center of gravity from the first crank angle and the second crank angle; and

controlling engine ignition timing so that the third crank angle ~~becomes~~ approximates a specified target crank angle.